Transformations in Lighting
2010 DOE SOLID-STATE LIGHTING R&D WORKSHOP

February 2 – February 4, 2010
Raleigh Convention Center
Raleigh, NC

_____ *Workshop Agenda* _____

Tuesday, February 2, 2010

11:00 a.m. *Registration Opens*

1:00 p.m. **Welcome & Introduction**
James Brodrick, Lighting Program Manager, DOE

1:30 **Keynote: What Are the Limits for SSL?**
Shuji Nakamura, University of California, Santa Barbara
Insights on SSL technology progress—what are the limits in efficacy and performance, and how far can we take this technology to meet our energy-saving needs?

2:15 *Refreshment Break*

2:45 **A Fresh Look at Priorities—The DOE SSL R&D Multi-Year Plan**
Fred Welsh, Radcliffe Advisors
A preview of proposed updates to the DOE SSL R&D multi-year plan, including feedback from the Fall 2009 Roundtable discussions on R&D priorities.

3:15 **Panel 1: The Limits of Efficacy**
James Brodrick, DOE, Moderator
Gain an in-depth understanding of the nuances that impact SSL efficacy as this panel explores strategies for reaching the "perfect" LED. The OLED speakers will consider the opportunities for area lighting, critical barriers to success, and ways to overcome them.

How Eliminating Defects Can Improve LED Efficiency
Christian Wetzel, Rensselaer Polytechnic Institute

Does Current Packaging Technology Limit LED Device Efficacy?
Steve Paolini, Lunera Lighting, Inc.

Improving the Color Spectrum to Increase LED Efficacy
Yoshihiro Ohno, National Institute of Standards and Technology

OLEDs at 150 lm/W? What Are the Barriers?
Mike Hack, Universal Display Corporation
Yuan-Sheng Tyan, Eastman Kodak Company

The Critical Issue of OLED Lifetime
Joe Shiang, GE Global Research

5:30 *Optional Walking Tour of Local Outdoor LED Lighting Installations*
Sponsored by Cree, Inc., and Progress Energy
Observe nearby parking facilities and street lighting installed as part of Raleigh's participation as an LED City.

Workshop Agenda

Wednesday, February 3, 2010

7:30 a.m. *Continental Breakfast*

8:00 **Panel 2: Lessons from the Field**
Marc Ledbetter, Pacific Northwest National Laboratory, Moderator
Lessons from real-world installations continually expand our knowledge of SSL technology. This panel will share varied perspectives—from a designer/building owner, an installer, a municipality, and DOE—on lessons learned from recent installations, plus what we know one year (and three years) later.
Daniel Howe, City of Raleigh
Chip Israel, Lighting Design Alliance
Bruce Kinzey, Pacific Northwest National Laboratory
Mark Schulkamp, Mark Schulkamp Electric Company

9:30 **DOE SSL Research & Development Program Update**
An overview of the DOE SSL R&D portfolio, budget, and areas of focus, with recognition of project teams making significant contributions in 2009.
James Brodrick, Lighting Program Manager, DOE

10:00 *Refreshment Break*

10:30 **Invited Presentations on Significant DOE R&D Projects—2009 Achievements and Projects of Interest for 2010**

Closing the "Green Gap" in Multichip White LEDs
Andy Armstrong, Sandia National Laboratories

Enhancing Blue OLED Efficiency at High Brightness
Franky So, University of Florida

Using Advanced Phosphor Systems for Warm, Efficient LEDs
Christopher Summers, PhosphorTech Corporation

Developing a Cost-Effective Electrode for OLED General Illumination
Tony Burrell, Los Alamos National Laboratory

Improving LED Efficiency and Performance
Monica Hansen, Cree, Inc.

12:00 p.m. *Lunch*

1:00 **Invited Presentations on Significant DOE R&D Projects** (continued)

Progressing Toward Commercially Viable OLED Devices
Gary Silverman, Arkema Inc.

Developing a High-Efficiency LED Downlight
Robert Harrison, Osram Sylvania Development Inc.

Developing Commercially Viable OLED Panels
Mike Hack, Universal Display Corporation

Raising the Bar for Warm White LED Luminaire Performance
Decai Sun, Philips Lumileds Lighting

2:30 *Refreshment Break*

3:00 **Panel 3: Reliability and Lifetime**
Fred Welsh, Radcliffe Advisors, Moderator
There is little consistency, no data, and few hard facts around LED luminaire lifetime numbers. This panel will explore the challenge of defining true lifetime and reliability, and review methods, metrics, and underlying root causes of failure being considered by a DOE working group.

What Do We Mean by Luminaire Lifetime?
Kevin Dowling, Philips Color Kinetics

How Can Lifetime Be Demonstrated*?*
David Szombatfalvy, GE

How Does Color Stability Relate to Product Life?
Terry Clark, Finelite

Thoughts about System Reliability
Mark Hodapp, Philips Lumileds Lighting

4:30 **Track Session I: LED/OLED Priorities**
Attendees will explore the proposed priority tasks from the updated multi-year plan.

LED Track Session I is a follow-up to Monday's "Limits of Efficacy" panel presentation. This session will consider how R&D can lead to higher packaged device efficacies through substrate development, emitter materials, down-conversion, and novel architectures.

Steve Bland, SB Consulting, Moderator
Michael Coltrin, Sandia National Laboratories
Steven DenBaars, University of California, Santa Barbara
James Ibbetson, Cree, Inc.

OLED Track Session I will address the limits to OLED efficiency, with an emphasis on materials considerations, electrode design and materials, outcoupling methods, and other issues related to basic device efficacy.

Mimi Gupta, Navigant Consulting, Moderator
Mike Hack, Universal Display Corporation
Mike Lu, Sagitta Research, LLC
Gary Silverman, Arkema Inc.

5:30–7:30 *Poster Session/Reception for all DOE-Funded Research & Development Projects*
Sponsored by the Next Generation Lighting Industry Alliance
More than 40 project posters will be presented by research team representatives, providing an opportunity to browse and ask questions of America's leading scientists.

Workshop Agenda

Thursday, February 4, 2010

7:30 a.m. *Continental Breakfast*

8:00 **Let's Talk: Designers, Specifiers, and Manufacturers**
Insights from a lighting designer on why it's so frustrating to specify and install LED lighting solutions today, from misleading or incomplete product literature to the lack of useful information about installation, maintenance, and replacement. How can we better communicate to make this process easier and the results more predictable?
Naomi Miller, Pacific Northwest National Laboratory

9:00 **Panel 4: Recognizing Quality in the Marketplace**
Ruth Taylor, Pacific Northwest National Laboratory, Moderator
National design competitions recognize quality SSL products on the market and offer valuable perspectives on the rapidly developing SSL market. This panel will start with an inside look at two national competitions, *Next Generation Luminaires™* and *Lighting For Tomorrow*, and share insights from 2009 winners about their product development process and the impact of design competitions.

Recognizing Quality Through National Design Competitions
Ruth Taylor, Pacific Northwest National Laboratory

Immersion™ Jewelry Case Lighting and AZARA Track Lighting
Ravi Kaushik, GE Lighting

10:00 *Refreshment Break*

10:30 **Panel 4: Recognizing Quality in the Marketplace** (continued)

High Output Six Inch Downlight
Gary Trott, Cree, Inc.

eW Cove Powercore
Kevin Dowling, Philips Color Kinetics

Discussion
Moderated discussion, with an opportunity for Q&A with the winners

12:00 p.m. *Lunch*

1:00 **Track Sessions: LED/OLED Priorities**
Attendees will explore the proposed priority tasks from the updated multi-year plan.

LED Track Session II will address overall luminaire performance, especially reliability. Building on Wednesday's Panel 3 presentation, this session will emphasize reliability methods and optimization, electronics reliability, and color maintenance options.

Morgan Pattison, SSLS, Inc., Moderator
Mehmet Arik, GE Global Research
Mark Hand, Acuity Brands Lighting
Gerard Harbers, Xicato

OLED Track Session II will address design optimization of OLED lighting. Considerable discussion on the tradeoffs between lifetime, cost, and brightness has occurred in the past year. This session will consider these issues in terms of panel design for practical OLED lighting.

Norman Bardsley, Bardsley Consulting, Moderator
Anil Duggal, GE Global Research
Curtis Fincher, DuPont OLEDs
Franky So, University of Florida

2:30 **Wrap-Up and Adjourn**
James Brodrick, Lighting Program Manager, DOE